Claims:

1. A method for recognizing an object in an image comprising the steps of:

   (a) acquiring in electronic memory an image of the model object;

   (b) transforming the image of the model object into a multi-level representation consistent with a recursive subdivision of the search space, said multi-level representation including at least the original image;

   (c) generating at least one precomputed model of the object for each level of discretization of the search space, said precomputed model consisting of a plurality of points with corresponding direction vectors, said points and direction vectors being generated by an image processing operation that returns a direction vector for at least each model point;

   (d) acquiring in electronic memory a current image;

   (e) transforming the current image into a multi-level representation consistent with a recursive subdivision of the search space, said multi-level representation including at least the original image;

   (f) performing an image processing operation on each transformed image of the multi-level representation that returns a direction vector for a subset of points within said image that corresponds to the range of translations for which the model should be searched;

(g) computing a match metric that uses the direction information of the model and the transformed image for all possible poses of the model in the coarsest discretization level of the search space;

(h) determining those model poses whose match metric exceeds a user-selectable threshold and whose match metric is locally maximal, and generating a list of instances of the model in the coarsest discretization level of the search space from said poses and said match metrics;

(i) tracking said instances of the model in the coarsest discretization level of the search space through the recursive subdivision of the search space until the finest level of discretization is reached; and

(j) providing the pose of the instances of the objects on the finest level of discretization.

2. The method of claim 1, wherein in step (c) for each level of discretization according to step (b), and for each transformation in the discretized search space at the current level of discretization according to step (b) the following steps are performed:

(c1) transforming the image of the current level of discretization by the current transformation using anti-aliasing methods;

(c2) performing feature extraction in the transformed image;

(c3) adding all segmented feature points along with their direction vectors to the list of transformed models.

3. The method of claim 1, wherein for each level of the discretization according to step (b) the following steps are performed:

(c1) performing feature extraction in the image of the current level of discretization; and for each transformation in the discretized search space at the current level of discretization:

(c2) transforming the extracted model points and direction vectors by the current transformation; and

(c3) adding all transformed model points along with their transformed direction vectors to the list of transformed models.

4. The method of claim 2, wherein step (i) is followed by the following step:

(i') discarding overlapping and/or extraneous model instances.

5. The method of claim 3, wherein step (i) is followed by the following step:

(i') discarding overlapping and/or extraneous model instances.

6. The method of claim 4, wherein step (i') is followed by the following step:

(ii") refining the pose information to a resolution better than the finest discretization level.

7. The method of claim 6, wherein (ii") comprises the step of extrapolating the maxima of the match metric.

8. The method of claim 7, wherein (ii) is followed by the following steps to further refine the pose:

(iii'') extracting feature points in the image

(iv'') robustly finding the correspondences between model points and image points

(v'') minimizing the average distance of the model points to the image points using a least-squares fitting alogrithim

9. The method of claim 7, wherein steps (c) and (f) comprise the step of performing feature extraction in the transformed image representation.

10. The method of claim 9, wherein line filtering, edge filtering, corner detection, or region-based segmentation is used for the feature extraction.

11. The method of claim 10, wherein in step (g) the sum of the dot product of the direction vectors of the transformed model and the image over all points of the model is used for computing said match metric.

12. The methods of claim 10, wherein the sum of the normalized dot product of the direction vectors of the transformed model and the image over all points of the model is used for computing said match metric.

13. The method of claim 10, wherein the absolute value of the sum of the normalized dot product is used for computing said match metric.

14. The method of claim 10, wherein the sum of the absolute values of the normalized dot products is used for computing said match metric.

15. The method of claim 10, wherein in step (g) the sum of the absolute values of the angles that the direction vectors in the model and the direction vectors in the image enclose is used for computing said match metric and where the local minima of the match metric are used to extract the pose information instead of the local maxima.

16. The method of claim 12 where the contribution of direction vectors that are caused by noise is discarded.

17. The method of claim 13 where the contribution of direction vectors that are caused by noise is discarded.

18. The method of claim 14 where the contribution of direction vectors that are caused by noise is discarded.

19. A system for recognizing an object in an image comprising the steps of:

(a) means for acquiring in electronic memory an image of the model object;

(b) means for transforming the image of the model object into a multi-level representation consistent with a recursive subdivision of the search

space, said multi-level representation including at least the original image;

(c) means for generating at least one precomputed model of the object for each level of discretization of the search space, said precomputed model consisting of a plurality of points with corresponding direction vectors, said points and direction vectors being generated by an image processing operation that returns a direction vector for at least each model point;

(d) means for acquiring in electronic memory a current image;

(e) means for transforming the current image into a multi-level representation consistent with a recursive subdivision of the search space, said multi-level representation including at least the original image;

(f) means for performing an image processing operation on each transformed image of the multi-level representation that returns a direction vector for a subset of points within said image that corresponds to the range of translations for which the model should be searched;

(g) means for computing a match metric that uses the direction information of the model and the transformed image for all possible poses of the model in the coarsest discretization level of the search space;

(h) means for determining those model poses whose match metric exceeds a user-selectable threshold and whose match metric is locally maximal, and generating a list of instances of the model in the coarsest

discretization level of the search space from said poses and said match metrics;

(i) means for tracking said instances of the model in the coarsest discretization level of the search space through the recursive subdivision of the search space until the finest level of discretization is reached; and

(j) providing the pose of the instances of the objects on the finest level of discretization.

20. A computer program product comprising program code means stored on a computer readable medium for performing the method of claim 1 when said program product is run on a computer.

21. A computer program comprising program code means for performing all steps of the methods according to claim 1 when said program is run on a computer.